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ABSTRACT

Peer-tutoring programs have been found to produce positive effects on student achievement. There has been relatively little research on the effects of tutor characteristics on the achievement of college students who receive tutoring. The purpose of this study was to investigate the relationship between the sex of tutors and students' sex on achievement in introductory-level science and math courses for students who received tutoring. The grades of 333 students were evaluated using analysis of variance. The results of this study indicate that students did better when they worked with a tutor of the same sex. The availability of same-sex tutors may provide a strategy for improving female students' achievement in college math and science courses. (Author)

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An Investigation of the Effect of Student and Tutor Gender on Grades Earned in College Mathematics and Science Courses

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Abstract

Peer-tutoring programs have been found to produce positive effects on student achievement. There has been relatively little research on the effects of tutor characteristics on the achievement of college students who receive tutoring. The purpose of this study was to investigate the relationship between the sex of tutors and students' sex on achievement in introductory-level science and math courses for students who received tutoring. The grades of 333 students were evaluated using analysis of variance. The results of this study indicate that students did better when they worked with a tutor of the same sex. The availability of same-sex tutors may provide a strategy for improving female students' achievement in college math and science courses.

The Effect of Student and Tutor Gender on Achievement in College Mathematics and Science

There have been a number of studies which have examined the positive effects of tutoring on the teaching-learning process. Several studies have found that tutoring programs produce positive effects on both academic performance and student attitudes toward school (Cohen, Kulik, & Kulik, 1982). In addition, tutoring appears to benefit both students being tutored and students serving as tutors (Baxter Magolda & Rogers, 1987; Rosen, Powell, Schubot, & Rollins, 1978).

Students who have been tutored are found to participate more often in class, do more outside reading, and be more satisfied with their academic performance (Eisenberg, Fresko, & Carmeli, 1981). Tutoring has also been shown to produce significant learning gains (Cohen, Kulik, & Kulik, 1982; Shaver & Nuhn, 1971). These learning gains from tutoring have been observed for several subjects including psychology (McKellar, 1986), reading and writing (Shaver & Nuhn, 1971), and mathematics (Watson, 1988). Tutoring appears to help students develop a positive attitude toward the subject studied in the tutoring process (Cohen, Kulik, & Kulik, 1982). These learning gains and positive attitudes toward school appear to be sustained for long periods of time after the tutoring has ended (Eisenberg, Fresko, & Carmeli, 1983; Shaver & Nuhn, 1971); both studies found that some positive effects of tutoring were still present two years after the tutoring was completed. Consequently, tutoring programs appear to be an effective method for improving student achievement.

Mathematics and science achievement has been an area of concern to educators. For students at the secondary and postsecondary levels, a considerable number of studies have examined sex differences in math and science achievement. Male students have consistently been found to do better in math and science, although the differences have been small (Steinkamp, Harnisch, Walberg, & Tsai, 1985). Students' socialization experiences and attitudes may be responsible for these small differences. For example, Wigfield and Meece (1988) reported girls' negative affective reactions to math as significantly stronger than those of boys in junior high and high school, and that negative affective reaction was significantly related to math performance. Specific teacher characteristics may be able to reduce the negative feelings of students toward math and science. As pointed out by Jones and Wheatley (1988), the sex of the instructor is important to student performance in science courses, and most science and math instructors at the college level are male.

Much of the earlier research on the benefits of tutoring programs were focused on students at the upper elementary or secondary levels. From these studies, it appears that learning gains are more noticeable when locally developed assessments are used rather than standardized tests, and better results are produced by structured tutoring programs (Cohen, Kulik, & Kulik, 1982). Irvine (1986) has indicated that more research is needed on the effects of the sex of teachers on students' performance, particularly observing students of different ability levels and educational levels. There has been relatively little research on the effects of tutor characteristics on the achievement of college level students who receive tutoring. Since sex of the instructor is important to female students' performance in science and math (Jones &

Wheatley, 1988), it is possible that having a same-sex tutor positively affects students' performance in those subjects. Consequently, the purpose of this study was to investigate the relationship between the sex of tutors and students' sex on achievement in introductory-level college science and math courses for students who received tutoring in a structured tutoring program. Based on the literature, it was hypothesized that students who worked with same-sex tutors would earn better grades than students who worked with opposite-sex tutors.

Methods

Students

There were 333 students (220 females, 113 males) who received tutoring for introductory-level mathematics (242 students) and science (biology and chemistry; 91 students) courses at a large public university during the 1987-88 academic year. Approximately 85% of the students were college freshmen and sophomores; the rest were juniors. Approximately 60% of the students receiving tutoring through the program were black and 68% were admitted to the university through a special admissions program for educationally disadvantaged students. Students either requested tutoring assistance on their own or were referred to the tutoring program by academic counselors. Students met with their tutors at least once per week during the semester for sessions which lasted a minimum of one hour. Students wanting tutoring were randomly assigned to a tutor.

Tutors

Tutors who participated in the program were juniors, seniors, and graduate students who were majors in the subject they were tutoring. Tutors were selected on the basis of their grades (a 3.00 GPA was necessary) and their performance in an interview. In preparation for their tutoring responsibilities, tutors received 11 hours of training each semester. This training was conducted partly through large group instruction and partly in smaller groups of tutors in the same subject. Tutors were given training in communications skills, study skills, learning styles, test anxiety, math anxiety, and test-taking skills.

Procedure

Students' grades (on a 4.00 scale) were compiled for the math and science courses for which they were tutored. A 2 X 2 (Student Sex X Tutor Sex) factorial design was used to evaluate the main effects of the difference between grades earned by male students and female students and the difference between grades earned by students of male tutors and students of female tutors, and the interaction effect of student sex and tutor sex on student grades.

Results

Means and standard deviations for the grades earned (A=4.0) in introductory-level science and math courses by students receiving tutoring assistance are presented in Table 1. These data are presented by tutor sex and student sex.

Insert Table 1 About Here

Analysis of variance results are presented in Table 2. The results indicate that tutor sex was not significant; there was no significant difference between the grades earned by students with male tutors and those earned by students with female tutors. This analysis also shows that student sex was not significant. In this study, male and female students earned grades that were not significantly different.

Insert Table 2 About Here

Finally, the results of this analysis indicate that there was a significant interaction effect between tutor sex and student sex. Students earned better grades when working with same-sex tutors than when working with opposite-sex tutors.

Discussion

There were three main findings from this study. First, there was no significant difference between the grades achieved by students who had female tutors and students who had male tutors. Second, there was no difference between the grades earned in introductory level math and science courses by male and female students. Finally, the results of

this study indicate that students did better when they worked with a same-sex tutor. This result was consistent with the original hypothesis of this study. There are several possible explanations for the findings of this study.

Earlier studies of tutoring effectiveness using younger students found that males and females were equally effective as tutors (Ehly & Bratton, 1981; Ehly & Larsen, 1976). Tutors' sex was not related to any learning differences or affective outcomes. The results of this study are consistent with those earlier findings and extend their generalizability to college students.

The second finding from this study was that there was no difference between the grades earned by male and female students. This is different than other studies which have documented better math and science performance by male students. Recent results have suggested, however, that there are some mathematical skills on which females perform better. Doolittle and Cleary (1987) found college-bound females to score better on test items requiring algorithmic or computational skills while males did better on items requiring geometry skills or reasoning skills. Consequently, the lack of a difference between males and females in this study may have been due to the students taking survey type introductory level courses which require a variety of skills, some of which are performed better by female students.

One possible reason for the finding that students performed better with a same-sex tutor was because same-sex tutors interact differently with their tutees. There are a number of studies that have examined teacher-student interactions and several specific behaviors have been found to be related to successful student performance in tutoring

situations (McKellar, 1986); these behaviors include the tutee asking for clarification of study material, the tutee asking the tutor about what topics are most important to learn, and the tutor elaborating information and explaining it in a context that is mutually familiar to both the tutor and tutee. Consequently, it is possible that same-sex tutors are more able to put information into a context that makes the material more understandable to the student. Also, students may be more likely to ask for further information or clarification from a same-sex tutor.

Another possibility is that same-sex tutors are more able to reduce students' anxiety about difficult subjects. Female students have been shown to have significantly stronger negative affective reactions to math and those negative affective reactions were significantly related to math performance (Wigfield & Meece, 1988). Learning situtations that are less stressful improve the performance of highly anxious students (Snow, 1986), and the presence of a same-sex tutor may serve to make the learning situation less anxiety producing.

Finally, it may be that students perceive same-sex tutors differently or that same-sex tutors communicate different expectations to their tutees. Rosen, Powell, and Schubot (1977) found that both student satisfaction and performance outcomes were related to the tutor and tutee having a relatively equitable tutoring relationship. Students may perceive a same-sex tutor as more equal to themselves than they do an opposite-sex tutor. Also, Medway and Baron (1977) found that the more material tutors expected their students to learn, the better the student performance. It is possible that female tutors

in this study expected more work for their female students, leading to better grades than those earned by female students who had male tutors.

There are several limitations to the present study. First, many of the students who sought or were referred for tutoring were educationally disadvantaged students. It is possible that the results of this study may not be generalizable to students of all ability levels. Second, the grades earned by these students were generally low. The lower grades may have reduced the probability of finding significant differences between male and female students, as has been the case in other studies of math and science achievement. Finally, this study evaluated the grades earned in introductory level courses. Additional studies are needed to see if these results would be the same for the more specialized material found in upper division courses. It is possible that differences between male and female students might become more noticeable in upper division courses.

The findings of this study are important for two reasons. First, these results provide several directions for further research. More study is needed to determine if students perform better with same-sex tutors because the tutor is available as a role model, because same-sex tutors explain material in a context that is more understandable and familiar to the student, or because same-sex tutors help reduce anxiety felt by students over difficult subjects. Further studies on the dynamics of same-sex pairs are needed to investigate these issues. Finally, further studies are needed on students of various ability levels and on courses of varying difficulty.

The second reason the results of this study are important is that they may provide a strategy for improving female students' achievement in college math and science courses. Having same-sex tutors may provide interaction opportunities that are more effective for learning for female students than the interactions typically found in college science and math courses.

The results of this study provide an example of the type of studies that can be done when institutional researchers collaborate with other academic units. The results of evaluations of instructional programs can provide data which will help improve the teaching and learning processes.

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Table 1

Means and Standard Deviations for Grades Earned in Science and Math

Student Sex	Tutor Sex	n	M	SD
Female	Female	133	1.35	1.04
Female	Male	87	1.01	1.03
Male	Female	63	1.30	1.10
Male	Male	50	1.50	1.22

Table 2

Analysis of Variance Summary Table for Student Grades

Source	df	MS	F
Tutor Sex	1	0.34	0.29
Student Sex	1	3.60	3.09
Tutor Sex X Student Sex	1	5.17	4.44*
Residual	329	1.16	

*p<.05.